detecting X-ray radiation transmitted through said ensemble of objects, and providing to said computer X-ray data corresponding to the intensity of transmitted radiation,

calculating a value characteristic of said target object of said specific material of interest in said ensemble of objects, and therewith identifying said target object,

utilizing in said calculation x-ray transmission data of rays passing through said ensemble of objects, including rays passing through said target object of said specific material of interest as well as rays passing near but not through said target object to remove the contribution of overlying and underlying material from the calculated value characteristic of said target object of said specific material of interest, and

automatically indicating the presence of said target object while said ensemble of objects progresses on said conveyor.

83. The method of claim 82 wherein x-ray data from rays that pass through different regions of said target object of said specific material of interest are employed in said calculation.

84. The method of claim 82 wherein said stationary x-ray exposure system exposes said ensemble to at least one fan beam of x-ray radiation to produce said x-ray data.

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4 ~~85.~~ 1 The method of claim ~~82~~ wherein said ensemble is exposed to x-ray radiation at more than one energy to produce said x-ray data and the resulting data at more than one energy is used in calculating said value characteristic of said target object of said specific material of interest.

5 ~~86.~~ 4 The method of claim ~~85~~ wherein said x-ray radiation at each energy is of fan beam form.

8 ~~87.~~ 2 ~~82~~ ~~85~~ 4 The method of claim 82, ~~85~~ or ~~86~~ wherein said ensemble comprises an article of luggage or package and its contents and said step of exposing comprises employing at least one fan beam of x-ray radiation emanating from said x-ray exposure system and moving the article on a conveyor past said at least one fan beam.

9 ~~88.~~ 8 The method of claim ~~87~~ wherein the transmitted fan beam of x-ray radiation is detected by at least one linear array of detectors of said x-ray detection system.

10 ~~89.~~ 1 ~~82~~ 4 ~~85~~ The method of claim ~~82~~ or ~~85~~ wherein said value that is characteristic of said target object relates directly to a physical characteristic of the specific material of said target object.

11 ~~90.~~ 10 The method of claim ~~89~~ wherein said physical characteristic is the atomic number Z.

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~~91~~. The method of claim ~~82~~ or ~~85~~ wherein said target object of said specific material of interest is one of the following: plastic explosives, other explosives, drugs and money.

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~~92~~. The method of claim ~~82~~ or ~~85~~ employed to detect plastic explosive objects in packages or luggage which contain harmless objects having Z values of plastics different from said plastic explosive.

D Cont.

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~~93~~. The method of claim ~~82~~ wherein said exposure system and said detection system produce dual image information of said ensemble and said computer processes the resultant dual image information to detect said specific material on the basis of comparisons of selected subareas of the exposed area of said ensemble to other subareas thereof in the vicinity of the selected subareas.

15 14

~~94~~. The method of claim ~~93~~ wherein said exposure system and said detection system produce said dual image information in the form of dual energy information.

16 14

~~95~~. The method of claim ~~93~~ employed to detect a bomb that may be present in said ensemble.

17 1, 82 4

~~96~~. The method of claim ~~82~~ or ~~85~~ used in conjunction with CT scanning of said ensemble.

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18 17
97. The method of claim 96 employed to produce information relevant to three dimensional spatial configurations of objects within said ensemble.

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98. The method of claim 96 used in conjunction with a separate CT scanner.

20 17
99. The method of claim 96 in which said x-ray exposure system and said x-ray detection system are deployed to also perform CT scanning.

21 1 2 3 4
100. The method of claim 82 or 85 used as a preliminary scan to inspect articles of luggage and packages on-line substantially in real time, and CT scanning is thereafter performed on suspect regions of said articles as determined by said preliminary scan.

22 1 2 3 4
101. The method of claim 82 or 85 used to indicate suspect slices in articles of luggage and packages, followed by CT scanning of said suspect slices.

23 1 2 3 4
102. The method of claim 82 or 85 wherein said computer is programmed to automatically indicate presence and location of said target object on a video display.

24 1 2 3 4
103. The method of claim 82 or 85 wherein said computer is programmed to determine an image of said target

object by first identifying a region exhibiting said value that is characteristic of said target object and then employing a dilation algorithm upon said x-ray data to determine nearby regions that have similar values.

25 ~~104~~. The method of claim 24 ~~103~~ wherein the determined image of said target object is displayed on a video display.

26 ~~105~~. The method of claim 24 ~~103~~ wherein presence of said target object is indicated by an alarm.

27 ~~106~~. The method of claim 24 ~~103~~ wherein said computer is further programmed to reduce noise of the predetermined image by applying an erosion algorithm.

28 ~~107~~. The method of claim 27 ~~106~~ wherein the resultant noise-reduced image is displayed on a video display.

29 ~~108~~. The method of claim 2 ~~82~~ 1 ~~83~~ 4 or ~~85~~ wherein said computer employs, for reference information, a predetermined lookup table based on actual measurements performed on said specific material of interest under varying conditions.

30 ~~109~~. The method of claim 29 ~~108~~ wherein said varying conditions comprise variations in thickness of said specific material of interest.

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110. The method of claim 82 or 85 wherein said calculating includes calculating values substantially related to the logarithm of the energy of rays transmitted through the target object of the specific material of interest and of rays transmitted not through the target object but through regions adjacent to the target object and then subtracting from the resultant target values part or all of the resultant adjacent region values.

111. The method of claim 85 wherein said x-ray exposure system emits alternately pulses of x-ray radiation of two substantially different x-ray energies.

112. The method of claim 85 wherein said x-ray exposure system includes at least one x-ray source that emits polychromatic x-ray radiation, and said x-ray detection system includes two sets of x-ray detectors that detect x-ray radiation of respectively different x-ray energies.

113. The method of claim 82 or 85 wherein said x-ray exposure system produces timed emissions of x-ray pulses and said x-ray detection system and said computer operate co-operatively so that said detection system collects x-ray data during emission of said x-ray pulses and said detection system collects "no x-ray flux" data between pulses when no x-rays are emitted from said x-ray exposure system, said computer further programmed to receive both said x-ray data and said "no x-ray flux" data from said

detection system and to correct said x-ray data by equalizing said x-ray data with said "no x-ray flux" data.

114. The method of claim 82 or 95 wherein the step of identifying said target object employs evaluation of the magnitude of the gradient of the calculated values over the area of the ensemble that has been exposed to said x-ray radiation.

115. A device for detecting a target object of a specific material of interest in an ensemble of objects, for use with a conveyor arranged to move said ensemble of objects through an inspection station comprising:

a stationary X-ray exposure system, a stationary X-ray detection system, and a computer operatively connected to said detection system,

said X-ray exposure system positioned to expose, at said inspection station, said ensemble of objects to X-ray radiation,

said X-ray detection system positioned to detect X-ray radiation transmitted through said ensemble of objects, and constructed to provide to said computer X-ray data corresponding to the intensity of transmitted radiation,

said computer programmed to calculate a value characteristic of said target object of said specific material of interest in said ensemble of objects, and therewith identifying said target object,

said computer programmed to utilize in said calculation x-ray transmission data of rays passing through said ensemble of objects, including rays passing through said target object of said specific material of interest as well as rays passing near but not through said target object to remove the contribution of overlying and underlying material from the calculated value characteristic of said target object of said specific material, and

said computer programmed to indicate the presence of said target object.

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~~116.~~ The device of claim ~~115~~ wherein said computer is programmed to employ x-ray data from rays that pass through different regions of said target object of said specific material of interest in performing said calculation.

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~~117.~~ The device of claim ~~115~~ wherein said stationary x-ray exposure system is constructed to expose said ensemble to at least one fan beam of x-ray radiation to produce said x-ray data.

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~~118.~~ The device of claim ~~115~~ wherein said x-ray exposure system is constructed to expose said ensemble to x-ray radiation at more than one energy to produce said x-ray data and the computer is programmed to employ resulting data at more than one energy is used in calculating said value characteristic of said target object of said specific material of interest.

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38 ~~119.~~ 37 The device of claim ~~118~~ wherein said x-ray exposure system is constructed to produce said x-ray radiation at each energy in fan beam form.

40 ~~120.~~ 34 37 38 The device of claim ~~115, 118~~ or ~~119~~ constructed to receive said ensemble in the form of an article of luggage or package and said exposure system directs at least one fan beam of x-ray radiation through said article of luggage or package as the article moves past said at least one fan beam.

1 Cont

41 ~~121.~~ 40 The device of claim ~~120~~ wherein said detection system is arranged to detect the transmitted fan beam of x-ray radiation with at least one linear array of detectors.

42 ~~122.~~ 34 37 The device of claim ~~115~~ or ~~118~~ wherein said value that is characteristic of said target object is selected to relate directly to a physical characteristic of the specific material of said target object.

39 ~~123.~~ 37 The device of claim ~~118~~ wherein said physical characteristic is the atomic number Z.

43 ~~124.~~ 34 37 The device of claim ~~115~~ or ~~118~~ wherein said target object of said specific material of interest is one of the following: plastic explosives, other explosives, drugs and money.

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44 34 37

125. The device of claim 115 or 118 programmed to detect plastic explosive objects in packages or luggage which contain harmless objects having Z values of plastics different from said plastic explosive.

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126. The device of claim 115 wherein said exposure system and said detection system are constructed to produce dual image information of said ensemble and said computer is programmed to process the resultant dual image information to detect said specific material on the basis of comparisons of selected subareas of the exposed area of said ensemble to other subareas thereof in the vicinity of the selected subareas.

D'cont

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127. The device of claim 126 wherein said exposure system and said detection system produce said dual image information in the form of dual energy information.

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128. The device of claim 126 programmed to detect a bomb that may be present in said ensemble.

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129. The device of claim 115 or 118 in combination with means for CT scanning of said ensemble.

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130. The combination of claim 129 constructed and arranged to produce information relevant to three dimensional spatial configurations of objects within said ensemble.

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131. The combination of claim 129 having a CT scanner separate from said device.

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132. The combination of claim 129 in which said x-ray exposure system and said x-ray detection system of said device are deployed to also perform CT scanning.

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133. A system including the device of claim 115 or 118 and CT scanning means, said device constructed and arranged for use as a preliminary scan to inspect articles of luggage and packages on-line substantially in real time, and said CT scanning means arranged thereafter to inspect suspect regions of said articles as determined by said preliminary scan.

53 34 37

134. A system including the device of claim 115 or 118 constructed and arranged to indicate suspect slices in articles of luggage and packages and CT scanning means arranged to scan said suspect slices.

54 34 37

135. The device of claim 115 or 118 wherein said computer is programmed to automatically indicate presence and location of said target object on a video display.

55 34 37

136. The device of claim 115 or 118 wherein said computer is programmed to determine an image of said target object by first identifying a region exhibiting said value that is characteristic of said target object and then employing a

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dilation algorithm upon said x-ray data to determine nearby regions that have similar values.

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~~137.~~ The device of claim ~~136~~ constructed to display the determined image of said target object on a video display.

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~~138.~~ The device of claim ~~136~~ constructed to indicate presence of said target object is indicated by an alarm.

58 55

~~139.~~ The device of claim ~~136~~ wherein said computer is further programmed to reduce noise of the predetermined image by applying an erosion algorithm.

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~~140.~~ The device of claim ~~139~~ constructed and arranged to display the resultant noise-reduced image is displayed on a video display.

60 34 37

~~141.~~ The device of claim ~~115~~ or ~~118~~ wherein said computer is programmed to employ, for reference information, a predetermined lookup table based on actual measurements performed on said specific material of interest under varying conditions.

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~~142.~~ The device of claim ~~141~~ wherein said varying conditions comprise variations in thickness of said specific material of interest.

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62 34 37

143. The device of claim ~~115~~ or ~~118~~ wherein said computer is programmed to calculate values substantially related to the logarithm of the energy of rays transmitted through the target object of the specific material of interest and of rays transmitted not through the target object but through regions adjacent to the target object and then subtracting from the resultant target values part or all of the resultant adjacent region values.

D cont.

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144. The device of claim ~~115~~ wherein said x-ray exposure system is constructed to emit alternately pulses of x-ray radiation of two substantially different x-ray energies.

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145. The device of claim ~~115~~ wherein said x-ray exposure system includes at least one x-ray source that emits polychromatic x-ray radiation, and said x-ray detection system includes two sets of x-ray detectors that detect x-ray radiation of respectively different x-ray energies.

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146. The device of claim ~~115~~ or ~~118~~ wherein said x-ray exposure system is constructed to produce timed emissions of x-ray pulses and said x-ray detection system and said computer arranged to operate co-operatively so that said detection system collects x-ray data during emission of said x-ray pulses and said detection system collects "no x-ray flux" data between pulses when no x-rays are emitted from said x-ray exposure system, said computer further programmed to receive both said x-ray data and

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said "no x-ray flux" data from said detection system and to correct said x-ray data by equalizing said X-ray data with said "no x-ray flux" data.

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147. The device of claim ~~115~~ 34 or ~~118~~ 37 wherein said computer is programmed to identify said target object by evaluation of the magnitude of the gradient of the calculated values over the area of the ensemble that has been exposed to said x-ray radiation.

D'cont.

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148. The device of claim ~~115~~ 34 or ~~118~~ 37 including an interface of said computer with a computer network that utilizes the indications produced by said device.

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149. For detection of a threat object, the device of claim ~~115~~ 34 or ~~118~~ 37 in combination with a second computer programmed to utilize the indications from said device and additional threat processing software.

69

150. A baggage inspection system including the device of claim ~~115~~ 34 or ~~118~~ 37 and a further apparatus constructed to respond to indications from said device to facilitate a further inspection.

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151. The inspection system of claim ~~150~~ 69 wherein said further apparatus is a CT scanner.

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